

## Appendix M: Coal Resources

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## **M. Coal Resources: Coal Development Potential and Unsuitability Criteria**

### **M.1 Background**

Coal may occur at several stratigraphic intervals within the planning area, including the Cretaceous Eagle, Judith River, Hell Creek and the Paleocene Fort Union formations. The Eagle formation outcrops (comes to the surface) over a large area, forming rimrocks along the Yellowstone and Clarks Fork River valleys. Coal is found in the middle (shale) member of the Eagle formation. Valuable coal occurs in an area bounded on the north by Rock Creek, and on the south and east by the Clarks Fork (see Figure M-1). Shale or bone partings separate the coal into as many as three distinct beds. These partings may have influenced how the coal was mined and its overall quality.

A major fault offsets the Eagle outcrop effectively dividing coal development into two separate coalfields the Bridger and Joliet/Fromberg (see Figure M-1). Underground mines were opened in this area in the late 1800s. Most development occurred at a mine located west of Bridger, where the coal was thickest, though several smaller mines were opened west of Fromberg. The mines shut down in the 1930s. No total production figures are available, although over 100,000 tons were produced in 1907.

The coal resources for the Bridger coalfield can only be estimated. There has been no recent exploration and the only records are from mines abandoned nearly 75 years ago. The coalfield covers 13,660 acres, of which, 9,240 acres are federally owned. If the measured thickness of 4 feet of coal is consistent throughout the field, the total coal resource is about 95 million tons (64 million tons federal). Due to the presence of numerous thin partings, no more than 50% of the coal, 32 million tons, would be recoverable through normal underground mining methods.

There has been some interest expressed in federal coal in the Joliet/Fromberg coalfield. A group had obtained leases on private coal near the outcrop and lease options from some surface owners overlying federal coal. Federal coal ownership forms nearly a solid block of coal 3 to 4 miles wide and ½ mile inside the outcrop.

The BLM has identified federal coal having development potential through either surface or underground mining (Berg, 1982). The area of strippable coal totals 1,360 acres, of which 320 acres are federal. Coal resources within that area were estimated at 12.7 million tons (2.32 million tons federally owned). At a 90% recovery rate, over 2 million tons of federal coal are considered surface mineable.

The area of underground minable coal in the Joliet/Fromberg coalfield is much larger. Approximately 8,680 acres of federally owned coal occurs in this area. Overall, 68.7 million tons of coal resources have been identified (45.8 million tons federal coal). Assuming that underground mining would be by the room and pillar method, 50% of the coal, or 34.4 million tons (23.3 million tons federal coal) would be recoverable.

The Silvertip and Stillwater coalfields (see Figure M-2 and Figure M-3) contain coal from the shale member of the Eagle formation. The coal is fairly uniform, averaging a thickness of about 4 feet in two or three beds separated by shale partings. Only small quantities of coal were produced from either field, though many prospects were noted on older topographic maps, and some may still be visible on the ground. The only potential for renewed development in these fields would be small quantities for local domestic use, which is unlikely. Coal development in the Silvertip coalfield may conflict with production from the Elk Basin Oil Field, which occupies a similar area.

Federal ownership of coal is scattered in the Stillwater coalfield. The coal outcrop in the Silvertip Field occurs almost entirely within federal ownership. No accurate estimate of the recoverable coal resources within these fields may be made at this time.

The Judith River and Hell Creek formations contain coal which is generally thin (less than 2 feet thick) and often has a high content of volcanic ash, lowering its quality. These formations outcrop in western Musselshell and Yellowstone counties and northern Carbon County. Very little of this coal is federally owned. Development potential is considered low.

The Bull Mountains coalfield contains coal from the Tongue River member of the Fort Union formation (see Figure M-4). Twenty-six coal beds have been mapped and named. The geologic structure of the field is a shallow basin, with the north flank having a steeper pitch. Coal beds outcrop in the form of a ragged bulls-eye, with younger beds exposed more toward the center. Most of these coals are important only in portions of the field, since they thin or are absent elsewhere.

The most important coal development to date has occurred in the Roundup bed. Most of the 39.8 million tons produced from this bed, have been from underground mines near Roundup, and Klein, Montana. This coal may be mined out, with no further production potential.

The two coal beds creating the most interest at this time are the McCleary and Mammoth-Rehder. The McCleary bed lies relatively low in the Tongue River member. It is distinguishable throughout the field, but is only important in the northeastern portion (south of Melstone) where it may reach 8 feet in thickness. The Keane underground mine produced coal from the McCleary in the early 1900s, but it has since closed. Previous Department of Interior studies had indicated areas where federal coal has high to moderate potential for development either through surface or underground mining methods (McKay, 1982). The area of surface mineable coal totals 5,640 acres, of which 1,280 acres are federally owned. Coal resources within that area were estimated to be 42.6 million tons (8.9 million tons federal). At a 90% recovery rate, over 8 million tons of federal coal in the McCleary bed is considered recoverable. The corresponding area of underground minable coal covers 3,120 acres, containing 25.5 million tons of coal. The federal ownership in this area is 400 acres, resulting in 1.78 million tons mineable. Assuming the coal would be mined by room and pillar method, 50%, or 0.89 million tons would be recoverable. Should longwall mining be used, the potential coal recovery rate would be higher.

The Mammoth-Rehder coal bed lies near the middle of the Tongue River member. It consists of an underlying Mammoth coal bed (averaging 9 feet thick) separated from the overlying Rehder bed (2 to 5 feet thick) by a parting which varies from 0 feet thick in the southeast, to 35 feet in

the western part of the field (producing one 13' thick coal bed). This coal bed is the thickest and most consistent in the field. Though the coal is often burned at outcrop, the burning did not progress far beyond the outcrop.

This coal bed may be developed through both surface and underground mining. The basinal structure of the Bull Mountains limits surface mining to a  $\frac{1}{4}$  to  $\frac{3}{4}$  mile wide strip along the outcrop of the coal bed (see Figure M-4). Within this area (58,040 acres), about 604 million tons (308 million tons federal) of coal resources may be found, of which probably, 90% are recoverable.

Almost the entire coal bed may be developed through underground mining methods. The BLM has identified over 590 million tons of coal underlying over 32,500 acres. Federal ownership is 255 million tons underlying 14,000 acres. Depending upon the mining method, 50-60% of this coal may be recoverable.

Given the relatively high coal quality, surprisingly little development has occurred, though the coal was heavily prospected in the period 1910-1920. It was probable that these coal beds were too inaccessible to develop at that time.

The PM Coal Company opened a small underground mine in the Mammoth-Rehder bed in 1932 that produced Burlington Northern Railroad-owned coal until 1973. In 1973, PM Coal Company opened the PM Surface Mine which produced 15,000 to 25,000 tons of coal per year from the Mammoth-Rehder coal bed.

The Divide Coal Company had operated an underground mine in the Mammoth-Rehder bed for many years on privately owned coal. In 1962, the company was issued a Federal lease (M-052647) and began mining federal coal. The mine was converted from an underground mine to a surface operation in 1972 (the company felt it could not economically comply with the Federal Coal Mine Health and Safety Act of 1969). The Divide Coal Company was mining in the direction of the abandoned underground mine.

In the early 1970s, Consolidation Coal Company and the Montana Bureau of Mines and Geology completed various investigations on the quantity and quality of the Mammoth-Rehder coal bed and regional hydrology in the Bull Mountains area. Consolidation Coal Company opened a test pit in the northwestern part of the field in 1971. To determine its suitability for generating electricity, approximately 50,000 tons of coal was mined. The company also wanted to test several reclamation techniques. Though the coal proved suitable for use in coal-fired utilities, no further development followed.

In this area, bed thickness, quality and structure was obtained on the Burlington Northern coal. From this data (Conner. 1980; 1981), a preliminary high to moderate surface mineable potential map was prepared, using a cutoff strip ratio (overburden to coal) of 20:1 (see Figure M-4). It was understood that using this high of a ratio value may include coal tonnages which may not be economically minable. It does, however, permit further study of all acreage underlain by coal having some potential for development. Coal with overburden thicknesses greater than this ratio value would not likely be developed, unless by underground mining methods. The federal coal ownership in this area is checker boarded encompassing almost 44% of the coal in the field.

Figure M-5 shows the area of surface mineable coal based on a 10:1 stripping ratio. The coal is currently of high development potential. However, the 20:1 ratio value will be used in determining high and moderate development potential coal.

Louisiana Land and Exploration Company continued coal investigations in the Bull Mountains area and began undertaking environmental and economic feasibility studies in 1979, with the hope of obtaining a permit to underground mine Burlington Northern-owned coal. The company withdrew its application in late 1981 after determining that new development was economically unfeasible.

Meridian Land and Minerals Company (a wholly owned subsidiary of Burlington Northern) had expressed interest in exchanging federal coal rights for Burlington Northern coal rights in the Bull Mountains area with the intention of consolidating their coal holdings. Two land exchanges occurred with the BLM, one in 1991 and the other in 1993.

A stumbling block to coal mining in the Bull Mountains area at the time was the lack of rail service. The Burlington Northern Railroad had purchased the Milwaukee Road right-of-way between Slayton and Gage, so only the construction of a spur would be required to obtain access to the coal field. Other forms of transportation to carry large tonnages of coal were impractical.

In the late 1980s, Meridian Land and Minerals Company acquired the rights to mine coal in the area and also purchased the PM Mine. In 1989 and 1990, they permitted and mined a surface test pit adjacent to the underground mine (Bull Mountains Mine No. 1) and extracted approximately 180,000 tons of coal for test burn purposes. They also submitted a permit application to the Montana Department of Environmental Quality (MDEQ) for reopening the existing Bull Mountains Mine No. 1 in 1990, and was issued a state mine permit in 1993. Since that time, the permit has transferred to several ownership entities and was acquired by Signal Peak Energy (SPE) in 2008. In 2008, SPE also submitted an application to the BLM to acquire the federally-owned coal reserves on five lease tracts. The lease tracts, totaling 2,679.76 acres, contain an estimated 61.4 million tons of in-place coal reserves in the Mammoth/Rehder coal bed.

In 2009, SPE successfully amended their state mine permit to incorporate both continuous and longwall underground mining methods. A 35 mile rail line has been constructed connecting the mine to the Burlington Northern/Santa Fe mainline track near Broadview, Montana. The coal mine is currently producing coal at a 10 million ton per year rate.

Since 2006, Carpenter Creek, LLC has been in the process to develop a surface mine in the Carpenter Creek and McCleary beds in an area approximately 5 miles south of Melstone. The company submitted a mine permit application to MDEQ for a test pit on private coal in this area. Future expansion could possibly include federal coal using both surface and underground mining methods. In 2010, Great Northern Properties assumed control of the mine permitting effort.

The Red Lodge-Bearcreek coalfield also contains coal from the Fort Union formation. Here, nine separate beds, totaling 71 feet of coal occur in an 825 foot stratigraphic interval. The coalfield is limited on the east and north by the line of outcrop, on the south by the gradual thinning of the beds, and on the southwest by the Beartooth thrust fault. West of Rock Creek, the



coals lie in a narrow, steeply dipping zone which again terminates against the Beartooth fault. Small geologic structures interrupt the general southwesterly dip of the bedding. Several thin igneous dikes cut the strata, but they did not interfere with past coal mining. The coal field includes the Red Lodge and Bearcreek mining districts, which are separated by a high topographic ridge.

There is a long history of coal mining in the Red Lodge and Bearcreek areas. Mining began near Red Lodge in 1882. Production increased from 232,000 tons in 1886 to over 1 million tons by 1917. Most of the coal was used by the Northern Pacific Railway, though some went to the Anaconda smelter near Butte. Around 1924, demand for this coal began to diminish due to competition from the open pit mine at Colstrip. In 1932, the mines closed. Over 11 million tons of coal had been produced, entirely by underground, room and pillar mining. Coal was even mined under the town of Red Lodge.

Mining in the Bearcreek area progressed a little behind the Red Lodge area. Production was very limited until the railroad from Bridger to Bearcreek was completed in 1906. At least eight companies were operating in the area in the early 1900s. Production peaked in the early 1920s, then began to decline in 1926 due to competition from oil and gas. World War II gave impetus for increased production, but after the war production again declined. After abandonment of the Bearcreek -Belfry railroad spur in 1953, only small scale mining and trucking of coal to Red Lodge kept the field from closing completely. Eventually, all mining activity ceased. Total production from the district was 13 million tons. The Beartooth Coal Company, owned by Portland General Electric, reopened the Brophy underground mine in 1980. That year, over 7,000 tons of coal were produced. Due to labor problems and a soft market, the mine shut down.

Though abandoned underground mines in the Red Lodge-Bearcreek coalfield produced coal in the proximity of federal lands, there has been no recent exploration to determine the thickness, extension, or depth of the several coal beds below federal lands in this field. Therefore, an estimate of the coal resources may only be very grossly made. Should the thickness of the nine coal beds described above remain consistent (which is unlikely), federal lands may contain as much as 600 million tons of coal, of which only half would be recoverable by underground mining methods. Federal coal ownership forms a nearly solid block 2 to 3 miles inside the outcrop of the various beds.

Only in the Bull Mountains coalfield may federal coal be developed by surface mining methods. Surface owners of land overlying federal coal from both the Mammoth-Rehder and McCleary beds were consulted to determine their preference for or against leasing of their land for surface mining. The results of the consultation are shown in Table 2.3. Federal coal was found unacceptable for further consideration where the surface owners responded negatively to surface mining.

For the same reason, the unsuitability criteria were only applied in the Bull Mountains coalfield to coal which passed through the above "screen". The results of that application may be seen in Section M.3.3. The unsuitability criteria will not be applied to underground minable coal until a mine plan application is received which identifies the location of proposed surface facilities.

Figure M-1 Joliet Fromberg/Bridger Coal Map

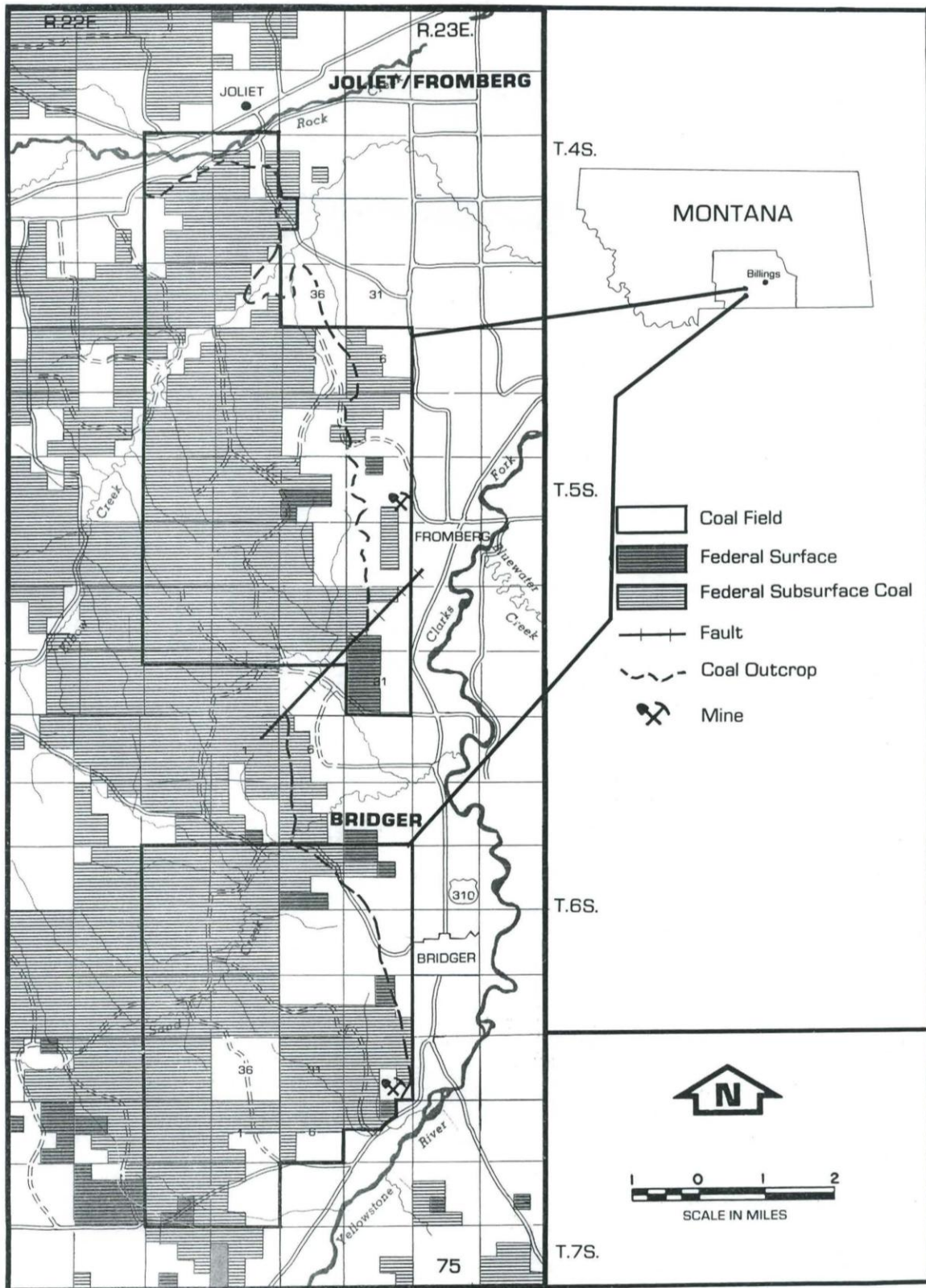


Figure M-2 McCleary Coal Bed and Silvertip Coal Field Map

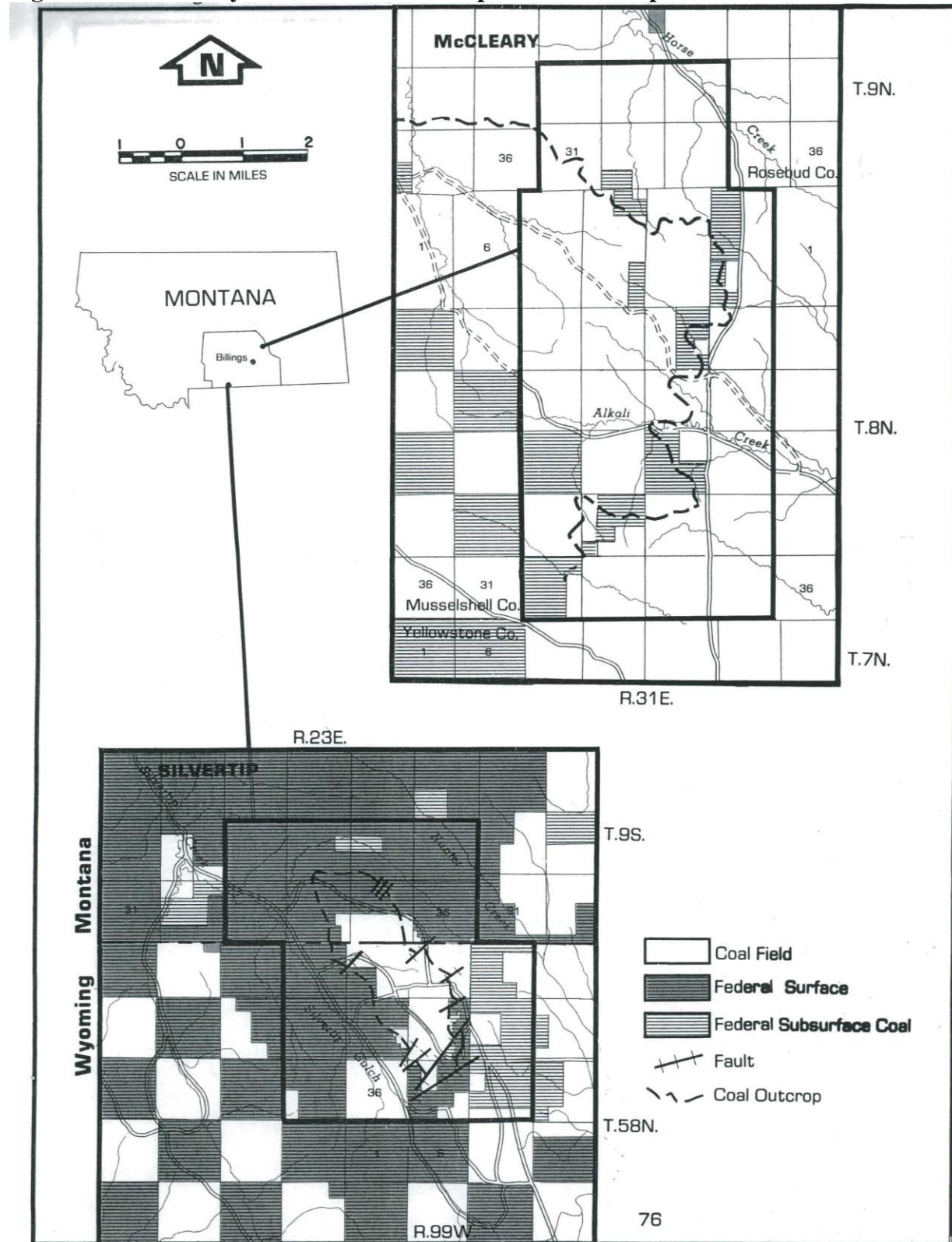




Figure M-3 Stillwater and Bearcreek Coal Fields

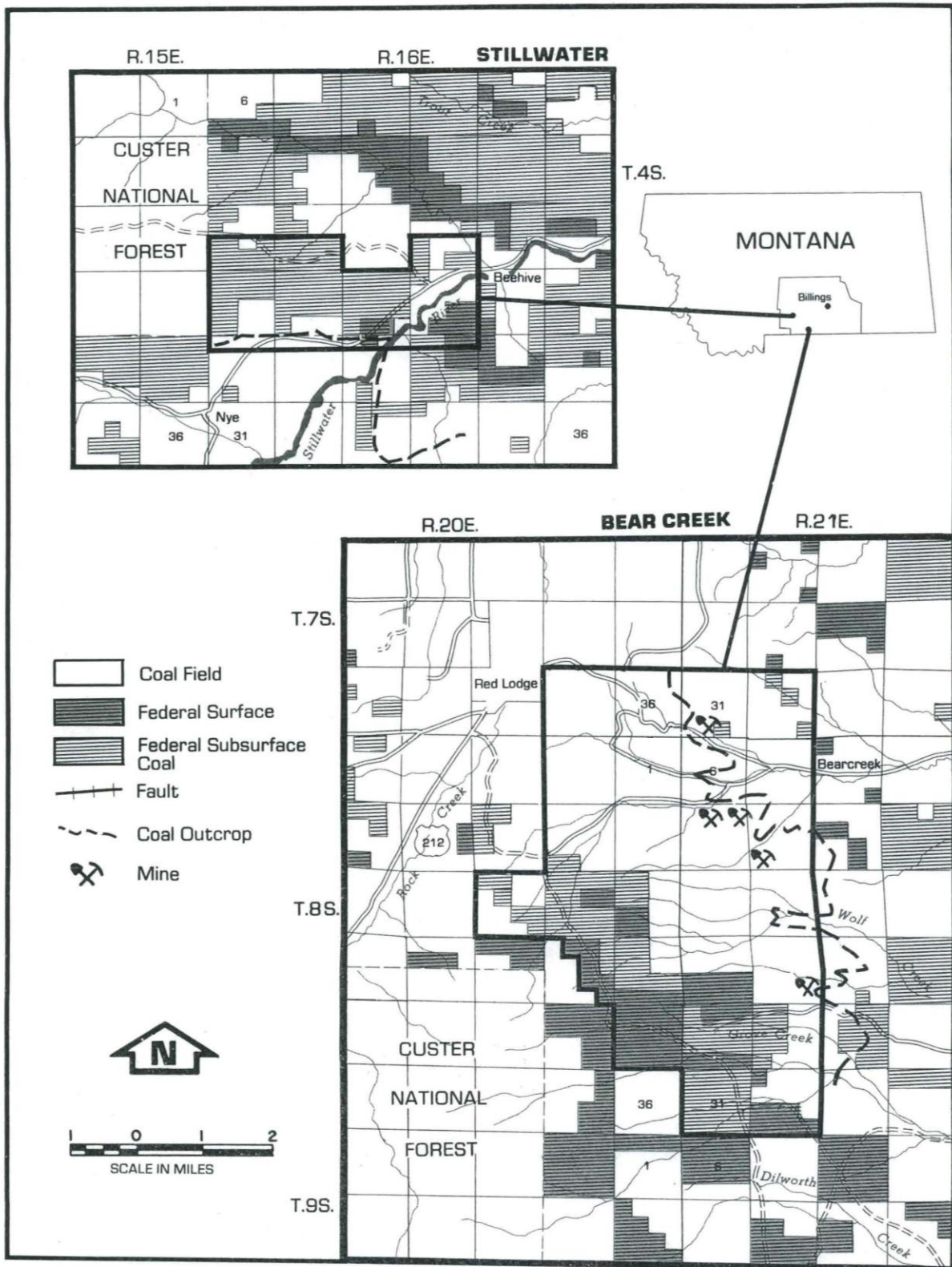


Figure M-4 Mammoth-Reder Coal Bed (20:1 ratio)

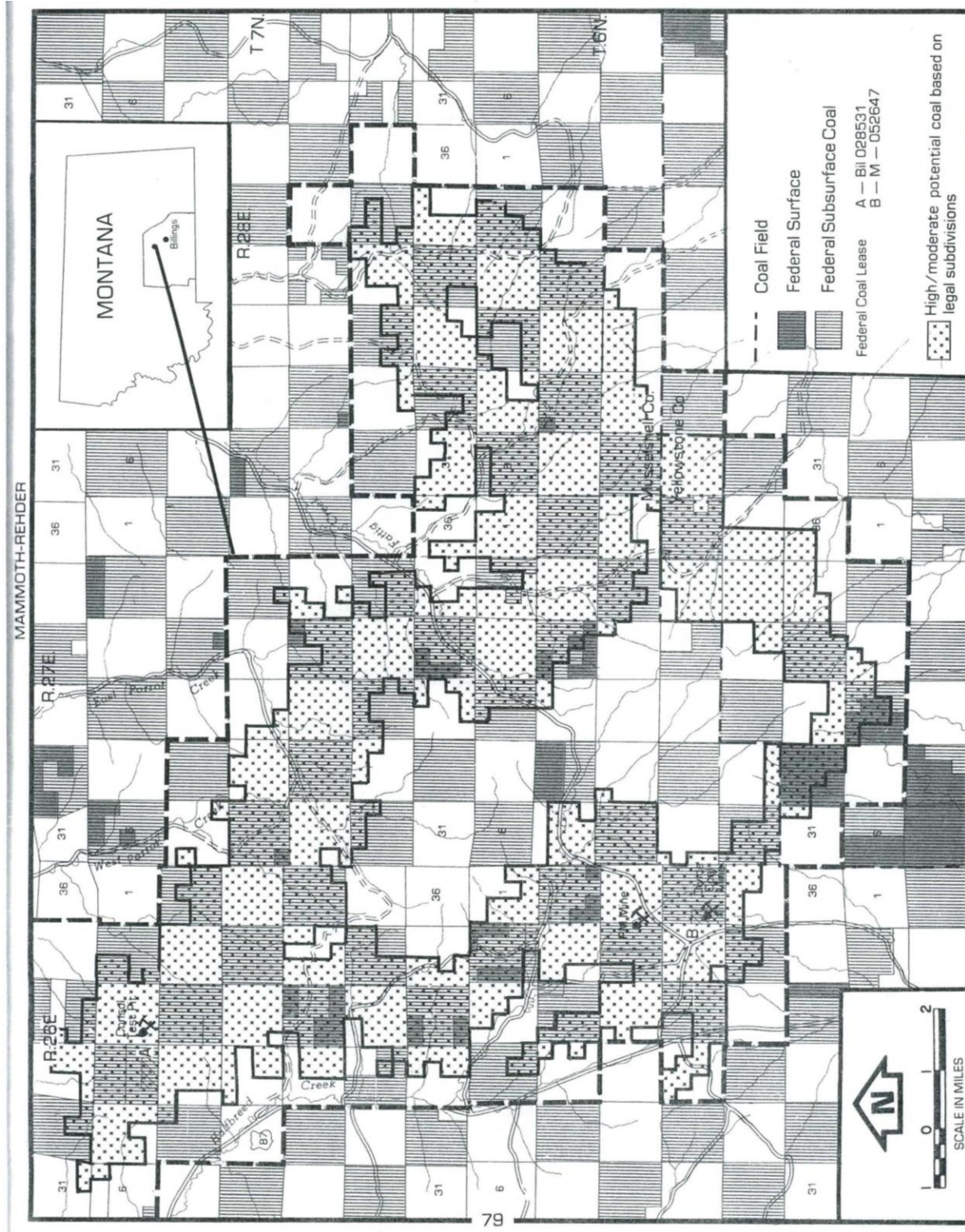
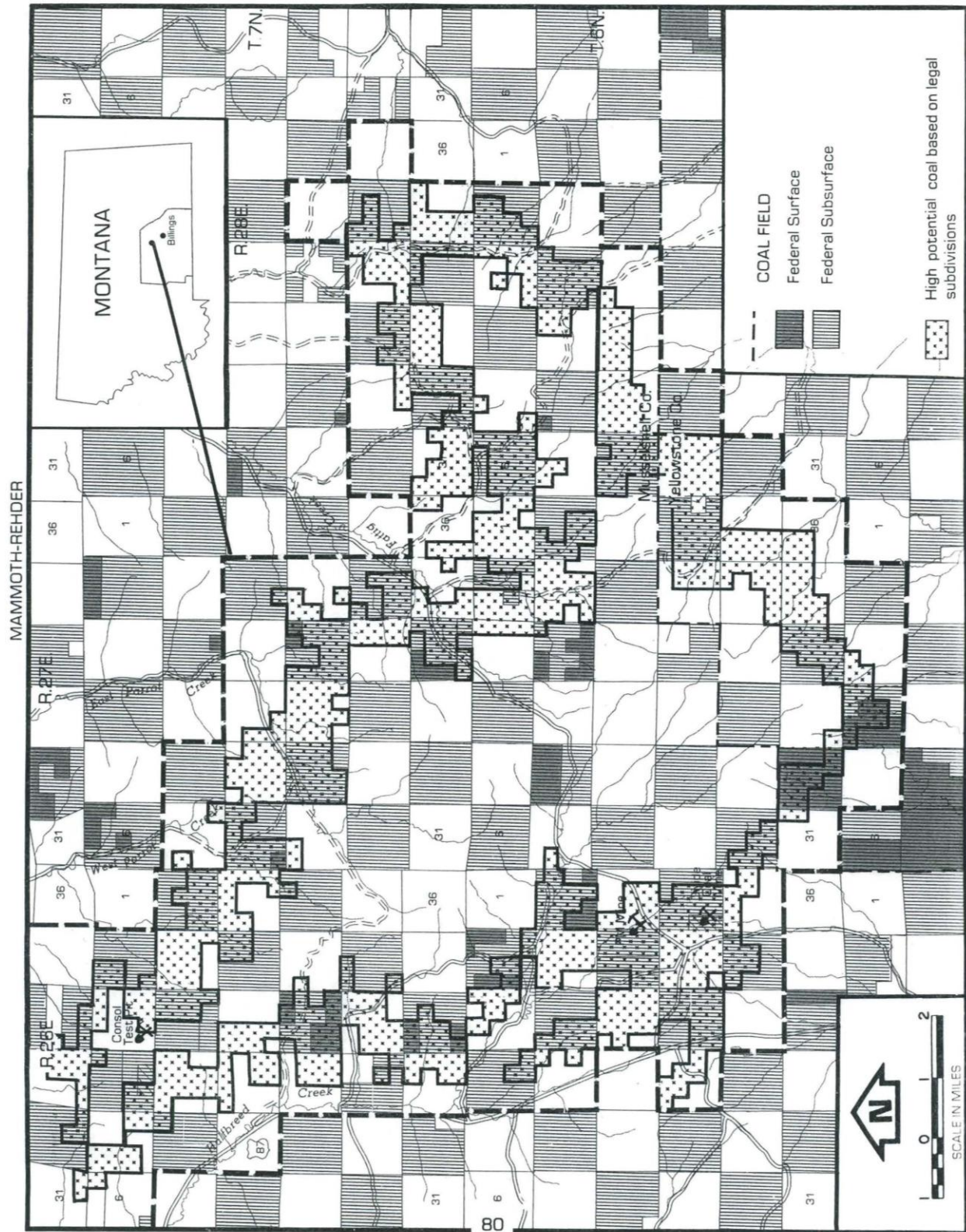




Figure M-5 Mammoth-Reder Coal Bed (10:1 ratio)



## M.2 Coal Unsuitability Criteria

Provided below is a description of the criteria for assessing lands suitable for all or certain stipulated methods of coal mining.

Criterion Number 1: All federal lands included in the following land systems or categories shall be considered unsuitable: National Park System, National Wildlife Refuge System, National System of Trails, National Wilderness Preservation System, National Wild and Scenic Rivers System, National Recreation Areas, lands acquired with money derived from the Land and Water Conservation Fund, National Forests, and federal lands in incorporated cities, towns and villages.

Exceptions: (i) A lease may be issued within the boundaries of any National Forest if the Secretary finds no significant recreational, timber, economic or other values which may be incompatible with the lease; and (A) surface operations and impacts are incident to an underground coal mine or (B) where the Secretary of Agriculture determines, with respect to lands which do not have significant forest cover within those National Forests west of the 100<sup>th</sup> meridian, that surface mining may be in compliance with the Multiple-Use Sustained-Yield Act of 1960, the Federal Coal Leasing Amendments Act of 1976, and the Surface Mining Control and Reclamation Act of 1977. (ii) A lease may be issued within the Custer National Forest with the consent of the Department of Agriculture as long as no surface coal mining operations are permitted.

Exemptions: The application of this criterion to lands within the listed land systems and categories is subject to valid existing rights, and does not apply to surface coal mining operations existing on August 3, 1977. The application of the portion of this criterion applying to land proposed for inclusion in the listed systems does not apply to lands: to which substantial legal and financial commitments were made prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

Criterion Number 2: Federal lands that are within rights-of-way or easements or within surface leases for residential, commercial, industrial, or public purposes on federally owned surface shall be considered unsuitable.

Exceptions: A lease may be issued, and mining operations approved in such areas if the surface management agency determines that:

- i. All or certain types of coal development (e.g., underground mining) will not interfere with the purpose of the right-of-way or easement; or
- ii. The right-of-way or easement was granted for mining purposes; or
- iii. The right-of-way or easement was issued for a purpose for which it is not being used; or
- iv. The parties involved in the right-of-way or easement agree, in writing, to leasing; or

- v. It is impractical to exclude such areas due to the location of coal and method of mining and such areas or uses can be protected through appropriate stipulations.

Exemptions: This criterion does not apply to lands: to which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

Criterion Number 3: Federal lands affected by section 522(e)(4) and (5) of the Surface Mining Control and Reclamation Act of 1977 shall be considered unsuitable. This Includes lands within 100 feet of the outside line of the right-of-way of a public road or within 100 feet of a cemetery, or within 300 feet of a public building, school, church, community or institutional building, or public park, or within 300 feet of an occupied dwelling.

Exceptions: A lease may be issued for lands:

- i. Used as mine access roads or haulage roads that join the right-of-way for a public road;
- ii. For which the Office of Surface Mining Reclamation and Enforcement has issued a permit to have public roads relocated;
- iii. If, after public notice and opportunity for public hearing in the locality, a written finding is made by the authorized officer that the interests of the public and the landowners affected by mining with 100 feet of a public road will be protected;
- iv. For which owners of occupied buildings have given written permission to mine within 300 feet of their dwellings.

Exemptions: The application of this criterion is subject to valid existing rights, and does not apply to surface coal mining operations existing on August 3, 1977.

Criterion Number 4: Federal lands designated as wilderness study areas shall be considered unsuitable while under review by the Administration and the Congress for possible wilderness designation. For any federal land which is to be leased or mined prior to completion of the wilderness inventory by the surface management agency, the environmental assessment or impact statement on the lease sale or mine plan shall consider whether the land possesses the characteristics of a wilderness study area. If the finding is affirmative, the land shall be considered unsuitable. Unless issuance of noncompetitive coal leases and mining on leases is authorized under the Wilderness Act and the Federal land Policy and Management Act of 1976.

Exemption: The application of this criterion to lands for which the Bureau of land Management is the surface management agency and lands in designated wilderness areas in National Forests is subject to valid existing rights.

Criterion Number 5: Scenic federal lands designated by visual resource management analysis as Class I (an area of outstanding scenic quality or high visual sensitivity) but not currently on the National Register of Natural Landmarks shall be considered unsuitable. A lease may be issued if



the surface management agency determines that surface coal mining operations will not significantly diminish or adversely affect the scenic quality of the designated area.

Exceptions: This criterion does not apply to lands: to which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

Criterion Number 6: Federal lands under permit by the surface management agency, and being used for scientific studies involving food or fiber production, natural resources or technology demonstrations and experiments shall be considered unsuitable for the duration of the study, demonstration, or experiment, except where mining could be conducted in such a way as to enhance or not jeopardize the purposes of the study, as determined by the surface management agency, or where the principal scientific user or agency gives written concurrence to all or certain methods of mining.

Exemptions: This criterion does not apply to lands: to which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

Criterion Number 7: All districts, sites, buildings, structures and objects of historic, architectural, archeological, or cultural significance on federal lands which are included in or eligible for inclusion in the National Register of Historic Places, and an appropriate buffer zone around the outside boundary of the designated property (to protect the inherent values of the property that make it eligible for listing in the National Register) as determined by the surface management agency, in consultation with the Advisory Council on Historic Preservation and the State Historic Preservation Office shall be considered unsuitable.

Exceptions: All or certain stipulated methods of coal mining may be allowed if the surface management agency determines, after consultation with the Advisory Council on Historic Preservation and State Historic Preservation Office that the direct and indirect effects of mining, as stipulated, on a property in or eligible for the National Register of Historic Places will not result in significant adverse impacts to the property.

Exemptions: The application of this criterion to a property listed in the National Register is subject to valid existing rights, and does not apply to surface coal mining operations existing on August 3, 1977. The application of the criterion to buffer zones and properties eligible for the National Register does not apply to lands: to which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which permit has been issued.

Criterion Number 8: Federal lands designated as natural areas or as National Natural Landmarks shall be considered unsuitable.

Exceptions: A lease may be issued and mining operation approved in an area or site if the surface management agency determines that:

- i. With the concurrence of the state, the area, or site is of regional or local significance only;
- ii. The use of appropriate stipulated mining technology will result in no significant adverse impact to the area or site; or
- iii. The mining of the coal resource under appropriate stipulations will enhance information recovery (e.g. paleontological sites).

Exemptions: This criterion does not apply to lands: to which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which includes operations on which a permit has been issued.

Criterion Number 9: Federally designated critical habitat for threatened or endangered plant and animal species, and habitat for federal threatened or endangered species which is determined by the Fish and Wildlife Service and the surface management agency to be of essential value and where the presence of threatened or endangered species has been scientifically documented, shall be considered unsuitable.

Exception: A lease may be issued and mining operations approved if, after consultation with the Fish and Wildlife Service, the Service determines that the proposed activity is not likely to jeopardize the continued existence of the listed species and/or its critical habitat.

Exemptions: This criterion does not apply to lands: to which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

Criterion Number 10: Federal lands containing habitat determined to be critical or essential for plant or animal species listed by a state pursuant to state law as endangered or threatened shall be considered unsuitable.

Exception: A lease may be issued and mining operations approved it, after consultation with the state, the surface management agency determines that the species will not be adversely affected by all or certain stipulated methods of coal mining.

Exemptions: This criterion does not apply to lands: to which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

Criterion Number 11: A bald or golden eagle nest or site on federal lands that is determined to be active and an appropriate buffer zone of land around the nest site shall be considered unsuitable. Consideration of availability of habitat for prey species and of terrain shall be included in the determination of buffer zones. Buffer zones shall be determined in consultation with the Fish and Wildlife Service.

Exceptions: A lease may be issued if:

- i. It can be conditioned in such a way, either in manner or period of operation, that eagles will not be disturbed during breeding season; or
- ii. The surface management agency, with the concurrence of the Fish and Wildlife Service, determines that the golden eagle nest(s) will be moved;
- iii. Buffer zones may be decreased if the surface management agency determines that the active eagle nests will not be adversely affected.

Exemptions: This criterion does not apply to lands: to which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

Criterion Number 12: Bald and golden eagle roost and concentration areas on federal lands used during migration and wintering shall be considered unsuitable.

Exception: A lease may be issued if the surface management agency determines that all or certain stipulated methods of coal mining can be conducted in such a way, and during such periods of time, to ensure that eagles shall not be adversely disturbed.

Exemptions: This criterion does not apply to lands: to which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

Criterion Number 13: Federal lands containing a falcon (excluding kestrel) cliff nesting site with an active nest and a buffer zone of federal land around the nest site shall be considered unsuitable. Consideration of availability of habitat for prey species and of terrain shall be included in the determination of buffer zones. Buffer zones shall be determined in consultation with the Fish and Wildlife Service.

Exception: A lease may be issued where the surface management agency, after consultation with the Fish and Wildlife Service, determines that all or certain stipulated methods of coal mining will not adversely affect the falcon habitat during the periods when such habitat is used by the falcons.

Exemptions: This criterion does not apply to lands: to which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

Criterion Number 14: Federal lands which are high priority habitat for migratory bird species of high federal interest on a regional or national basis, as determined jointly by the surface management agency and the Fish and Wildlife Service, shall be considered unsuitable.

Exception: A lease may be issued where the surface management agency, after consultation with the Fish and Wildlife Service, determines that all or certain stipulated methods of coal mining will not adversely affect the migratory bird habitat during the periods when such habitat is used by the species.

Exemption: This criterion does not apply to lands: to which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

Criterion Number 15: Federal lands which the surface management agency and the state jointly agree are fish and wildlife habitat for resident species of high interest to the state and which are essential for maintaining these priority wildlife species shall be considered unsuitable.

Examples of such lands which serve a critical function for the species involved include:

- i. Active dancing and strutting grounds for sage grouse, sharp-tailed grouse, and prairie chicken;
- ii. Winter ranges most critical for deer, antelope, and elk; and
- iii. Migration corridors for elk.

A lease may be issued if, after consultation with the state, the surface management agency determines that all or certain stipulated methods of coal mining will not have a significant long-term impact on the species being protected.

Exemptions: This criterion does not apply to lands: to which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

Criterion Number 16: Federal lands in riverine, coastal, and special floodplains (100-year recurrence interval) on which the surface management agency determines that mining could not be undertaken without substantial threat of loss of life or property shall be considered unsuitable for all or certain stipulated methods of coal mining, and to the natural and beneficial values of the floodplain on the lease tract and downstream.

Exemptions: This criterion does not apply to lands: to which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

Criterion Number 17: Federal lands which have been committed by the surface management agency to use as municipal watersheds shall be considered unsuitable.

Exception: A lease may be issued where the surface management agency in consultation with the municipality (incorporated entity) or the responsible governmental unit

determines, as a result of studies, that all or certain stipulated methods of coal mining will not adversely affect the watershed to any significant degree.

Exemptions: This criterion does not apply to lands: to which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

Criterion Number 18: Federal lands with National Resource Waters, as identified by states in their water quality management plans, and a buffer zone of federal lands ¼ mile from the outer edge of the far banks of the water, shall be unsuitable.

Exception: The buffer zone may be eliminated or reduced in size where the surface management agency determines that it is not necessary to protect the National Resource Waters.

Exemptions: This criterion does not apply to lands: to which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

Criterion Number 19: Federal lands identified by the surface management agency, in consultation with the state in which they are located, as alluvial valley floors according to the definition in §3400.0-5(a) of this title, the standards in 30 CFR Part 822, the final alluvial valley floor guidelines of the Office of Surface Mining Reclamation and Enforcement when published and approved state programs under the Surface Mining Control and Reclamation Act of 1977, where mining would interrupt, discontinue or preclude farming, shall be considered unsuitable. Additionally, when mining federal land outside an alluvial valley floor would materially damage the quantity or quality of water in surface or underground water systems that would supply alluvial valley floors, the land shall be considered unsuitable.

Exemptions: This criterion does not apply to surface coal mining operations which produced coal in commercial quantities in the year preceding August 3, 1977, or which had obtained a permit to conduct surface coal mining operations.

Criterion Number 20: Federal lands in a state to which is applicable a criterion (i) proposed by that state, and (ii) adopted by rulemaking by the Secretary, shall be considered unsuitable.

Exceptions: A lease may be issued when:

- i. Such criterion is adopted by the Secretary less than 6 months prior to the publication of the draft comprehensive land use plan or land use analysis plan, or supplement to a comprehensive land use plan, for the area in which such land is included; or
- ii. After consultation with the state, the surface management agency determines that all or certain stipulated methods of coal mining will not adversely affect the value which the criterion would protect.

Exemptions: This criterion does not apply to lands: to which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

Underground mining exemption from criteria:

- a) Federal lands with coal deposits that would be mined by underground mining methods shall not be assessed as unsuitable where there would be no surface coal mining operations, as defined in §3400.0-5 of this title, on any lease, if issued.
- b) Where underground mining will include surface operations and surface impacts on federal lands to which a criterion applies, the lands shall be assessed as unsuitable unless the surface management agency finds that a relevant exception or exemption applies.

Source: CFR 3461.1, BLM, 1981

## M.3 Coal - Resource Objectives and Planned Actions

There are 9,360 acres of federal coal in the Bull Mountains found acceptable for further consideration for leasing, pending further study (see figures 2.1 and 2.2). These areas overlie federal coal which is of high or moderate development potential, based on a 20:1 (overburden to coal) surface mine stripping ratio. See Table M-1 for a breakdown of the acreages and tonnages dropped and carried forward for further consideration for leasing, pending further study (Billings RMP ROD 1984; pages 31-35).

**Table M-1 Results of Surface Owner Consultation and Application of Coal Unsuitability Criteria**

High/Moderate Potential Federal Strippable Coal		
	22,880 acres	326 MM tons
<b>I. SURFACE OWNER CONSULTATION</b>	<b>UNACCEPTABLE COAL</b>	
Surface owners opposed to leasing for surface mining	10,920 acres	174.3 MM tons
Federal lands within established subdivisions	2,480 acres	36 MM tons
Federal coal acceptable for further consideration	9,480 acres	116.7 MM tons
<b>II. UNSUITABILITY CRITERIA APPLICATION</b>	<b>UNSUITABLE COAL</b>	
Criterion # 3: Roads	0 acres	0 tons
Criterion # 3: Dwellings	24 acres	383,000 tons
Criterion # 16: Floodplains	96 acres	1,642,000 tons
Criterion # 19: possible alluvial valley floors (AVF)	298 acres	0 tons*
Federal coal suitable for further consideration pending application of Criteria # 7 and # 9-15	9,360 acres**	114.85 MM tons**

\* Final determination of alluvial valley floors has not been made; acreage will not be eliminated until final determination by OSM.

\*\* These acreages and tonnage totals consider the overlap of Criteria # 5, 3, 16, and 19.

Source: BLM 1982.

Current industry standards for surface mine coal recovery average 150 feet of overburden, or a 6:1 stripping ratio, whichever is less. In the Bull Mountains coalfield, the average thickness of the combined Mammoth-Rehder bed is 11 feet and the McCleary bed is 8 feet. Disregarding the interburden which separates the coalbeds, surface mining to a depth of 114 feet would be the current economic limit. Applying this consideration would greatly reduce the mineable acreage of the area found acceptable for further consideration, pending further study. If coal from the Bull Mountains is to be economically competitive, strong consideration must be given to adhere to a maximum 10:1 surface mine stripping ratio limit. This would tend to discourage large surface mining operations, yet support smaller surface operations. It is reasonable to assume that the deeper coal resource would be developed through underground mining methods. The overall effect of this recommendation will be a reduction of the area found acceptable for further consideration, pending further study, from 9,360 acres (20:1 ratio) to 4,704 acres (10:1 ratio). Appendices 2.4, 2.5, and 2.6 show the effect this change will have on the unsuitability criteria. More specific information concerning the surface owner consultation process is included in the

Billings Resource Area management situation analysis which is available for inspection in the Billings Resource Area Office.

All federal coal which is mineable by underground methods is suitable for further consideration for leasing or exchange, pending further study. The BLM will not apply coal unsuitability criteria to these areas until a site-specific mine plan is filed, detailing the proposed location of surface facilities.

This decision also eliminates from further consideration for leasing (federal coal which is potentially surface mineable) the following acreage in the Bull Mountains:

- 10,920 acres eliminated because of surface owner opposition
- 2,480 acres eliminated because lands are subdivided
- 418 acres eliminated as a result of the unsuitability application

This action specifically intends to encourage underground mining at the expense of other mining methods in the Bull Mountains. Large scale surface mining of federal coal in the Bull Mountains will be specifically discouraged and this will be the recommendation to be carried forward.

Federal coal lease applications will be considered on a case-by-case basis.

Federal coal exchange proposals will be considered on a case-by-case basis.

### **M.3.1 Rationale**

This action was selected because it will enable the BLM to comply with the multiple use mandates established by FLPMA and the 43 CFR 1600 regulations governing multiple use planning. Furthermore, it will allow the BLM to comply fully with the Surface Mining Coal Reclamation Act (SMCRA) and the 43 CFR 3400 regulations established to govern the federal coal management program. The coal areas found suitable for further consideration for leasing, pending further study will have criteria 7, 9-15 fully applied prior to leasing. Where overriding multiple use values not previously identified, are found to exist, the affected coal will be removed from further consideration for coal leasing. Due to the lower economic feasibility of surface mining coal at depths greater than 100 feet (the moderate potential coal), resulting in larger surface acreage disturbances, it will be recommended to allow surface mining only with a maximum 10:1 stripping ratio (high potential coal) limit. Underground mining will be encouraged, because it is less environmentally disruptive.

### **M.3.2 Implementation of Priorities**

The 9,360 acres of federal coal found acceptable for further consideration for leasing, pending further study in the Bull Mountains, will enter the activity planning stage including the application of unsuitability criteria 7, and 9-15. Any areas of overriding multiple use values not previously identified, will also be removed from consideration. As part of the multiple use consideration, it is recommended that surface mining only be allowed in areas where the



stripping ratio is 10:1, or less. Also recommend, that only small surface operations and underground operations be allowed in the Bull Mountains.

When federal coal lease applications are received, process on a case-by-case basis.

When federal coal exchange proposals are received, process on a case-by-case basis to determine if the public interest would be served in carrying out the exchange.

### **M.3.3 Application of Unsuitability Criteria (source: Appendix 2.4 (Billings RMP ROD 1984; page 75)).**

**Criterion #1:** There are no deposits of federal coal which lie within the Federal Land Systems described in 43 CFR 3461.1(a)(1) (100% reliability).

**Criterion #2:** There is no federally-owned surface encumbered by rights-of-way or easements within the surface mineable coal area (100% reliability).

**Criterion #3:** Several miles of county maintained roads cross federal lands. These rights-of-way and the appropriate buffer zones are considered unsuitable; no exceptions were applied. Several occupied dwellings lie on federal land. These dwellings and appropriate buffer zones are considered unsuitable; no exceptions were applied (100% reliability).

**Criterion #4:** There are no deposits of strippable federal coal which lie within designated wilderness study areas (100% reliability).

**Criterion #5:** There are no federal lands within the coalfield which have been designated by visual resource management analysis as Class I (an area of outstanding scenic quality or high visual sensitivity) but not on the National Register of Natural Landmarks (100% reliability).

**Criterion #6:** There are no federal lands within the coalfield which have been permitted for use for scientific study (100% reliability).

**Criterion #7:** Due to lack of adequate inventory, this criterion has not been applied (inadequate data).

**Criterion #8:** There are no designed or potential National Natural Landmarks within the coalfield (100% reliability).

**Criteria #9 - #15:** Due to the lack of adequate inventory, these criteria were not applied.

**Criterion #16:** The USGS has identified several drainages which flow through federal lands, portions of which qualify as special floodplains. These areas are considered unsuitable; no exceptions were applied (100% reliability).

**Criterion #17:** There are no federal lands which have been committed for use as municipal watersheds (100% reliability).

**Criterion #18:** There are no National Resource Waters within the coalfield (100% reliability).

**Criterion #19:** The BLM has identified several miles of preliminary Alluvial Valley Floors. These areas will not be considered unsuitable until a final determination is made by the Office of Surface Management and the State of Montana (date preliminary).

**Criterion #20:** No state proposed criteria have been developed and adopted by the Secretary.

Unsuitability criteria were only applied to federal lands within the Bull Mountains coalfield. Federal coal in other coalfields may only be developed through underground mining methods. The criteria will only be applied in these fields after receipt of a mining plan application which details the location of proposed surface operations and facilities.

**Table M-2 Application of Unsuitability Criteria Bull Mountain Coal Field (20:1 Stripping Ratio)**

Unsuitability Criterion	Acres Unsuitable	Tonnage (1)
#1 (see appendix 1.4 in FEIS for description)	n/a	0
#2	n/a	0
#3	0 miles of road; 3 buildings; 24 acres	383,000
#4	n/a	0
#5	n/a	0
#6	n/a	0
#7	(2)	
#8	n/a	0
#9	(2)	
#10	(2)	
#11	(2)	
#12	(2)	
#13	(2)	
#14	(2)	
#15	(2)	
#16	2 ½ miles: 96 acres	1,642,000
#17	n/a	0
#18	n/a	0
#19	5 miles: 298 acres	0 (3)
#20	n/a	0
<b>Totals</b>	120 acres	2,025,000 tons

Source: Appendix 2.5 (Billings RMP ROD 1984; page 76).

Footnotes:

- (1) Assume 11' of coal for Mammoth-Rehder; 8' of coal for McCleary bed; 1,873 tons/acre foot.
- (2) Criteria which have not been applied due to lack of available inventory.
- (3) Final determination on Alluvial Valley Floors by State of Montana and Office of Surface Management not completed; no coal eliminated.

**Table M-3 Application of Coal Unsuitability Criteria Bull Mountain Coal Field (10:1 Stripping Ratio)**

Unsuitability Criterion	Acres Unsuitable	Tonnage (1)
#1	n/a	0
#2	n/a	0
#3	2 occupied buildings; 16 acres	263,000
#4	n/a	0
#5	n/a	0
#6	n/a	0
#7	(2)	
#8	n/a	0
#9	(2)	
#10	(2)	
#11	(2)	
#12	(2)	
#13	(2)	
#14	(2)	
#15	(2)	
#16	1.2 miles: 50 acres	821,000
#17	n/a	0
#18	n/a	0
#19	1.2 miles: 180 acres	0 (3)
#20	n/a	0
<b>Totals</b>	17 acres	1,084,000 tons

Source: Appendix 2.6 (Billings RMP ROD 1984; page 77).

Footnotes:

- (1) Assume 11' of coal for Mammoth-Rehder; 8' of coal for McCleary bed; 1,873 tons/acre foot.
- (2) Criteria which have not been applied due to lack of available inventory.
- (3) Final determination on Alluvial Valley Floors by State of Montana and Office of Surface Management not completed; no coal eliminated.

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